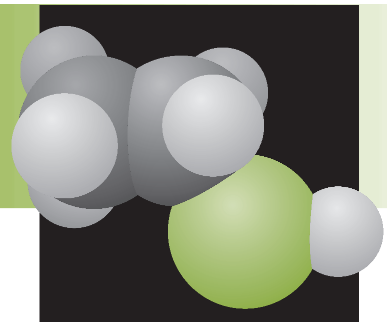
CHEMICALS

Project Fact Sheet



Direct Production of Silicones from Sand

Benefits

- Reduces energy consumption by as much as 47 percent
- Saves 6.1 trillion Btu and 3.8 billion kWh of electricity annually in 2020
- Saves 305,000 tons per year of coal in 2020
- Prevents 95,000 tons per year of solid waste from reaching landfills
- Reduces deposition of salt in waterways by 140,000 tons annually
- Eliminates 500,000 tons per year of carbon dioxide emissions

Applications

The new process will allow the silicones industry to produce a product that is 15 to 30 percent cheaper than at present. These lower-cost products will open new markets for silicone worldwide. A low-cost, high-performing, silicone rubber would be competitive with organic rubber used by the automotive, building, and construction industries.

Estimates are that, if successful, this technology will be adopted by 90 percent of the domestic chemical industry by 2020 for producing silicones cost-effectively.

New process will revolutionize the silicones industry

A new process is proposed for producing silicones from low-cost silicon dioxide (sand, quartz) that will bypass several energy-intensive stages and reduce many of the wastes generated by the present technology. Researchers hope to develop a new silicon-carbon bonding reaction that will allow a variety of silicon-carbon linkages. The new chemistry will in turn permit development of new lower-cost silicone materials that will be useful to industry and to consumers. The competitive cost of the new products will encourage wider application in elastomers, copolymers, flame retardants, and additives. Silicone-organic copolymers also offer attractive capabilities for industrial applications if they can be produced cost-effectively.

The new process eliminates the electrochemical conversion of silicon dioxide to elemental silicon. The use of high-risk hazardous reagents and processes will also no longer be necessary. This will lead to a significant reduction in the use of electricity and coal, in carbon dioxide emissions, and in the production of salt and other solid wastes by industry.

Benefits from the New Process to Manufacture Silicones

Process	Waste Generation	Energy Consumption	Cost
Current process:			
1. Silicon from silicon dioxide	low	high	moderate
2. Rochow Direct Process	moderate	moderate	moderate
New process:	low	low	low

The new process offers significant energy savings and waste reduction compared to the existing process.

Project Description

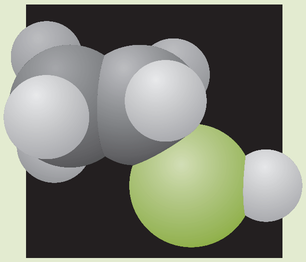
Goal: To develop a new chemical method for converting silicon dioxide directly into silicone polymers which will benefit the silicones industry by eliminating the energy-intensive, silicon-manufacturing step, and reducing energy use and waste production in several other stages.

In the old process, silicon dioxide (sand or quartz) is converted to elemental silicon, which is converted into a mixture of methylchlorosilanes that are purified to obtain the major reactants. In the new process, silicon dioxide is converted to a silane intermediate which is then converted into the silicone precursor, and these are polymerized to yield silicones.

The synthesis of the silicone precursor from the silane intermediate is a new chemical process. Another innovation will be the use of computational research to determine the best candidate for several reactions. For example, an economic analysis of the chemical engineering involved will determine which of the starting reagents and silane intermediates to choose for the process.

Progress and Milestones

- There are three phases to this five-year project, with milestones established at the end of each phase.
- Phase I of the project, the chemical synthesis phase, runs from mid-1998 to mid-2000.
- During Phase I, the economic analysis must show a projected return of 25 to 30 percent on the investment to proceed to retrofitting existing capacity with the new technology, and a return of more than 15 percent to begin construction of new plants.
- Phase II, bench scale-up, runs from mid-2000 to mid-2002.
- During Phase II, bench-, laboratory-, and pilot-scale reactors will be designed and built for synthesizing the silicone precursor and silane intermediate.
- Selection of viable alternatives to methyl silicones will be based on the efficiency of the chemistry and the market for the products.
- Phase III, pilot scaleup, will occur between mid-2002 and mid-2003.
- In Phase III, pilot-scale reactors will be built and optimized, and data collected for the economic assessment of the process.
- Upon completion of the project, a decision will be made about whether to proceed to commercialization of the new process.



Project Partners

GE Corporate Research and Development (GE-CRD)
Schenectady, NY

OM Group, Inc. (OMG)
Research Triangle Park, NC

Molecular Simulations Inc.
San Diego, CA

For additional information, please contact:

Amy Manheim
Office of Industrial Technologies
Phone: (202) 586-1507
Fax: (202) 586-3237
Amy.Manheim@ee.doe.gov
http://www.oit.doe.gov/IOF/chemicals

Please send any comments, questions, or suggestions to
webmaster.oit@ee.doe.gov

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Office of Industrial Technologies
Energy Efficiency
and Renewable Energy
U.S. Department of Energy
Washington, D.C. 20585

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